

## **Using Simulation Techniques to Estimate Management Parameters on Snake River Steelhead: Declines in Productivity Make Rebuilding Difficult**

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**Abstract.**—We collected adult and juvenile spawner recruit data on wild summer steelhead *Oncorhynchus mykiss* for the Snake River and estimated parameters for fisheries management by partitioning the data into predam and postdam periods and fitting the Ricker and Beverton–Holt models to those time series. The results showed a decline in productivity irrespective of the model chosen and the way in which the pre- and postdam periods were defined. However, the data were noisy and the confidence bounds on parameter estimates were fairly large. To reconcile the different management goals derived from the different data sources (adult or juvenile data) or model choice (Ricker or Beverton–Holt), we used simulation techniques and Bayesian algorithms. The combined approach suggests a recovery management goal (i.e., spawning stock associated with the maximum sustainable yield) of 60,000 steelhead above Lower Granite Dam. At current smolt-to-adult survival rates, the data indicate optimal escapement of between 20,000 and 27,000 adults. We note that Snake River steelhead stocks cannot be managed for recovery escapement levels given current estimates of smolt-to-adult survival rates, and we discuss alternatives for present-day management and rebuilding over time.

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